NOTES ON THE DISTRIBUTIONS OF SOME BUMBLEBEES OF WESTERN NORTH AMERICA

(Hymenoptera: Apidae)

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In recent research on some western species of bumblebees, I have found a number of geographic records which contribute significantly to the distributional knowledge of these species as summarized by Stephen (1957). These include the first California, Nevada and New Mexico records of *Bombus (Pryobombus) sylvicola* Kirby, the first California records of *B. (Alpinobombus) balteatus* Dahlbom, and confirmation of the occurrence of *B. (Cullumanobombus) rufocinctus* var. *henshawi* Franklin in the San Francisco Bay Area.

BOMBUS (PYROBOMBUS) SYLVICOLA Kirby

The distribution of *B. sylvicola* is listed by Burks (1951: 1252) as Pacific Coast, Oregon to Alaska; Rocky Mountain States, south to Colorado, Canada. The varieties of *B. sylvicola* and their distributions are listed by that author as: var. *gelidus*, Alaska; var. *johanseni*, North West Territories, Baffin Island; var. *sculleni*, Oregon; and var. *lutzi*, Arizona.

Stephen (1957: 127) states: "Before me is a long series of queens and workers from the higher elevations of eastern California, determined as *sylvicola* and bearing striking resemblance to that species. The absence of males prevents a positive species association, but on the basis of the known range of *sylvicola* it is very unlikely that these females belong to that species. It appears that *sylvicola* is strictly a Boreal form and is sparingly distributed along the Cascades as far south as Three Sisters ,Oregon." I have examined this material through the kindness of Dr. Stephen and have also studied several other collections from California which include males, thus allowing me to make a positive assignment of these specimens to the species *sylvicola*. Material examined is from the following localities:

ALPINE Co.: Higland Lake, 1♀, VIII-20-59 (P. M. Marsh, U.C.D.).[1] Hope Valley, 1 ♀, VII-9-48 (C. Chan, W.P.S.); 1 ♀, VII-18-48 (J. Abulhab, W.P.S.).

FRESNO Co.: Sixty-Lake Basin, 10,000 ft., 1♀, VIII-29-44 (E. I. Schlinger, W.P.S.).

[1] The abbreviations for the collections are as follows: California Academy of Sciences, San Francisco (C.A.S.); California Department of Agriculture, Sacramento (C.D.A.); California Insect Survey, University of California, Berkeley (C.I.S.); R. W. Thorp, Berkeley; (R.W.T.) University of California, Davis (U.C.D.); and W. P. Stephen, Oregon State, Corvallis (W.P.S.). Specimens without these abbreviations are in the possession of their collectors.

INYO Co.: Big Pine Creek nr. Glacier Lodge, 8-11,000 ft., 4 ♀, VIII-1929 (Isabel McCraken, C.A.S.). nr. Mono Pass, 12,000 ft., 4 ♀, VIII-12 to 15-57 (C. D. MacNeill, C.A.S.); 7 ♂, 4 ♀, VIII-8-61 (C. D. MacNeill, D. C. Rentz, M. R. Lundgren; C.A.S.); 2 ♀, VIII-8-61 (D C. Rentz, R.W.T.); 4 ♂, 8 ♀, VIII-9-61 (C. D. MacNeill, C.A.S.). Ruby Lake, 11,500 ft., 2 ♀, VIII-13-57 (C. D. MacNeill, C.A.S.); 10,000 ft., 3 ♂, 2 ♀, VIII-7-59 (M. Lundgren, R.W.T.).

MONO Co.: Mt. Barcroft, White Mts., 12,500 ft., 1 ♀, VII-5-61 (R. R. Friedricks, R.W.T.); 2 ♀, VII-21-61 (D. C. Rentz, R.W.T.). Blanco's Corral, White Mts., 10,000 ft., 2 ♀, VI-15-54 (D Burdick, C. D. MacNeill; W.P.S.); 2 ♀, VI-23-53 (D. D. Linsdale, R.W.T.); 6 ♀, 1 ♀, VI-23 to VII-20-53 (J. T. Brooks, W.P.S.); 7 ♀, VI-23 to VII-5-53 (W D. McLellan, W.P.S.); 16 ♀, VI-24 to 30-53 (J. W. MacSwain, W.P.S.); 1 ♀, VII-1953 (N. Malley, W.P.S.). Bodie 1 ♂, 3 ♀, VII-23-56 (G. I. Stage, R.W.T.); Cottonwood Cr., 9,300 ft., 2 ♀, VII-10-61 (J. K. Drew, D. R. Miller; R.W.T.). Crooked Cr., 10,150 ft., 4 ♀, VII-5-61 (R. W. Thorp, R.W.T.); 1 ♀, VII-7-61 (D. R. Miller, R.W.T.). Leavitt Mdw., 2 ♀, VII-6-51 (D. P. Lawfer, S. M. Kappos; W.P.S.). Rock Creek, 1 mi. W. Tom's Place, 3 ♂, 1 ♀, VIII-8-59 (D. C. Rentz). Saddlebag Lake, 1 ♀, VIII-31-36 (?, R.W.T.). Saddlebag Lake, 1 mi. S., near Tioga Pass, 2 ♀, VII-15-61 (J. K. Drew, R.W.T.). Sardine Crk., 8,500 ft., 1 ♀, VI-28-51 (D. P. Lawfer, W.P.S.); 1 ♀, VII-6-51 (D. P. Lawfer, W.P.S.); 1 ♀, VII-18-51 (A. T. McClay, W.P.S.). Tioga Pass, 1 ♂, 4 ♀, VII-16-42 (W. E. Ferguson). White Mtn., 14,000 ft., 1 ♀ VII-23-53 (W. D. McLellan, W.P.S.).

SHASTA Co.: Hat Lake, Lassen Nat. Park, 1 ♀, VI-14-41 (P. D. Hurd, W.P.S.).

SISKIYOU Co.: Castle Lake, 3 ♀, VII-22 to VIII-11-58 (J. Powell, C.I.S.).

TULARE Co.: Bird Lake, 3 ♂, 1 ♀, VIII-21-32 (Isabel McCracken, C.A.S.).

TUOLUMNE Co.: Bumble Bee, 1 ♀, VI-28-51 (T. R. Haig, W.P.S.). Conness Creek, Yosemite, 1 ♀, VII-24-36 (W. B. Herms, R.W.T.). Dana Fork, Tuolumne R., Yosemite N.P., 10,000 ft. 1 ♀. VIII-7-59 (D. W. Price, U.C.D.). Mt. Dana, Yosemite, N.P., 11,000 ft., 1 ♀, VII-28-36 (C. Ahrens, R.W.T.). Kennedy Mdw., 1 ♀, VII-29-59 (W. H. Lange U.C.D.). Kuna Crest, Yosemite N.P., 1 ♂, VIII-8-59 (D. W. Price, U.C.D.). Lyell Cyn., 1 ♀, VIII-17-47 (L. L. Jensen, W.P.S.). Sonora Pass, 9626 ft., 1 ♀, VI-26-37 (E. C. VanDyke, C.A.S.); 34 ♀, 5 ♀, VI-27 to VIII-18-51 (J. E. Balch, C. A. Downing, S. M. Kappos, D. P. Lawfer, C. D. MacNeill, J. W. MacSwain, A. T. McClay, R. W. Morgan, E. I. Schlinger; C.A.S., W.P.S.); 3 ♀, VII-30-54 (C. D. MacNeill, C.A.S.); 16 ♂, 22 ♀, VIII-25-55 (J. W. MacSwain, C.I.S.); 6 ♂, 3 ♀, IX-1-55 (W. E. Simonds, C.D.A.); 86 ♂, 2 ♀, 21 ♀, VII-29 to VIII-21-59 (D. D. Linsdale, M. Lundgren, J. W. MacSwain, C. W. O'Brien, J. Powell, J. R. Powers, R. R. Snelling, G. I. Stage, R. W. Thorp; C.I.S., R.W.T.); 1 ♀, VI-26-60 (R.W. Thorp, R.W.T.); 1 ♂, 1 ♀, VIII-10-60 (D. L. Palmquist): nr. Sonora Peak, 11,000 ft., 2 ♀, VIII-10-57 (C. D. MacNeill, C.A.S.); 1 ♀, IX-5-60 (D. C. Rentz, R.W.T.). 4.4 mi. W. Sonora Pass, 8,500 ft., 1 ♀, VII-29-59 (J. W. MacSwain, C..I.S.). Sonora Pass, 8-10,000 ft., 4 ♀, VII-10 to 11-57 (W. T. Crites U.C.D.).

I have also examined a worker of this species collected at

Truchas Peaks, Mora County, New Mexico, VIII-2-03 (W. P. Cockerell), in the collection of the Illinois State Natural History Survey, and I have two workers from Nevada as follows:

ELKO Co.: Lamoille, 8 mi. S.E., Ruby Mts., 1 ☿, VII-17-61 (J. F. Lawrence, R. W. T.). Lamoille, 14 mi. S.E., Ruby Mts., 1 ☿, VII-18-61 (J. F. Lawrence, R.W.T.).

The above cited specimens exhibit variation in colorational pattern. In the populations from the central Sierra Nevada there is a tendency for replacement of the reddish hairs on the second and third metasomal terga by black hairs. Some males in these populations lack reddish hairs on these terga and phenotypically resemble males of *B. bifarius nearcticus* Handlirsch, which occur in many localities with *B. sylvicola*. However, males of these two species may be readily distinguished by genitalic characters (Stephen, 1957). The females usually have some reddish hairs, at least on the apico-lateral margins of the second metasomal tergum. The reddish hairs on specimens from the Sierra Nevada populations vary from a bright orange-red to a dark ferruginous.

The workers and queens from the White Mountains of California and the workers from the Ruby Mountains of Nevada possess bright reddish hairs on the second and third metasomal terga and thus more closely resemble specimens from the Rocky Mountains of Colorado, than they do the Sierra Nevada populations.

All of the specimens I have seen from the principal cordilleran systems of the western United States (Sierra Nevada, Great Basin Mountains and Rocky Mountains) have shorter and less shaggy pile than specimens from Point Barrow, Alaska and Fort Churchill, Manitoba.

The correct taxonomic status of *B. sylvicola* has not been satisfactorily determined. For convenience, I am following the consensus of American workers over the past 50 years in calling this species *B. sylvicola*. Many European authors consider *B. sylvicola* to be a color form, race or subspecies of the Palaearctic *B. lapponicus* Fabricius (Friese, 1902; Skorikov, 1937; Pittioni, 1942, 1943 and Lindroth, 1957). Consequently, these European authors accord *B. lapponicus* a circumpolar distribution.

BOMBUS (ALPINOBOMBUS) BALTEATUS Dahlbom

The North American distribution of *B. balteatus* is listed by Burks (1951: 1253) as Rocky Mountain States, Canada and Alaska, with the varieties *arizonensis* and *alexanderi* occurring in Arizona. Franklin (1913) records this species from Truchas Peak,

New Mexico, and I have examined a male from this locality in the collection of the Illinois State Natural History Survey, collected on August 2, 1903 by W. P. Cockerell. Richards (1927) in a review of the subgenus *Alpinobombus* also records this species from Greenland, Norway, Lapland, Novaya Semlya, and Kareginski Is., Kamtchatka. However, Pittioni (1942) says that the Greenland and Novaya Semlya rceords pertain to *B. arcticus* Kirby and not to *B. balteatus*. The lists of color forms and synonymies for this circumpolar species are extremely long and complex (Friese & Wagner, 1912; Richards, 1927; Pittioni, 1942) and will require thorough evaluation before the relationships of this and other species of the subgenus *Alpinobombus* are understood.

Dr. W. P. Stephen has informed me in personal correspondence that he did not include *B. balteatus* in his paper (Stephen, 1957) because "all of the *balteatus* I have or have examined, occur from middle British Columbia into the Arctic Tundra."

California specimens of this species were found to be extremely rare in collections; I have seen only seven specimens as follows:

INYO CO.: nr. Mono Pass, 12,000 ft., 2 ♂, VIII-8-61 (C. D. MacNeill, D. C. Rentz, M. R. Lundgren; C.A.S., R.W.T.).

MONO CO.: Tioga Pass, 1 ♂, VII-16-42 (W. E. Ferguson, R.W.T.). Mt. Barcroft Lab., White Mts., 9 airline mi. N. Inyo Co. line, 12,500 ft., 2 ♀, VII-21-61 (J. Powell, C.I.S.).

TUOLUMNE CO.: Sonora Pass, 1 ♂, VIII-15-59 (G. I. Stage & R. R. Snelling, R.W.T.); and 1 ♂, VIII-21-59 (D. D. Linsdale, R.W.T.).

The males were identified by means of the genitalic characters figured by Richards (1927). The slight color variation which exists among the above cited specimens seems to reflect age and wear rather than phenotypic variation.

BOMBUS (CULLUMANOBOMBUS) RUFOCINCTUS VAR. HENSHAWI Franklin

Franklin (1913) originally described *B. henshawi* from two queen cotypes, one from San Francisco and one from Palo Alto, California. He stated at that time "This species is very closely allied to *B. rufocinctus* Cress., and it possible that extensive collecting will show that it should be considered either a subspecies or a color variant of that species." Burks (1951: 1248), working from manuscript notes of T. H. Frison, synonymized *henshawi* as a color variety of *rufocinctus*. However, Stephen (1957) says: "The broad gap between known California records of *rufocinctus* and *henshawi*, and the fact that extensive collecting in the Bay

Area has not produced any specimens resembling *rufocinctus* or *henshawi,* make me somewhat skeptical of Frison's synonymy, *rufocinctus* var. *henshawi.*"

I have seen many males, workers and some queens of *rufocinctus* which were recently collected in the San Francisco Bay Area. Although I have not been able to study the cotype queens of *henshawi,* in spite of an intensive search for the one deposited at Stanford University, several of the queens before me fit the description given by Franklin (1913). The queen of *henshawi* is distinct from other color variants of *rufocinctus* in that it lacks yellow pubescence on the first and second metasomal terga. Of the seven queens examined, three possess some yellow pubescence on these terga, and four are typical *B. henshawi* Franklin. Among the workers only one specimen fits the typical *henshawi* color pattern. The other worker specimens exhibit the typical color pattern of *rufocinctus* as redescribed by Franklin (1913). The males from the Bay Area population show much variation in color, fitting the color variants 1, 5 and 8 described by Franklin (1913).

Bombus rufocinctus Cresson exhibits polychromatic variation throughout its geographic range. Several color forms may be found in one nest (Stephen, 1957). The range of color variation evident in the Bay Area specimens together with their morphological agreement with other color forms of *B. rufocinctus* lead me to accept Frison's synonymy of *B. rufocinctus* var. *henshawi.* The collection data for the material I have examined are:

SAN FRANCISCO CO.: San Francisco, 1 ♀, II-16-61 (R. Brown, R.W.T.).

SAN MATEO CO.: San Bruno Mts., 4 ♂, VI-23-57 (D.C. Rentz, R.W.T.); 1 ♂, VII-13-57 (D. C. Rentz, R.W.T.); 87 ♂, 35 ☿, VII-2 to 19-60 (J. F. Lawrence, J. R. Powers, G. I. Stage, and R. W. Thorp; mostly in R.W.T.); 1 ♀, II-25-61 (J. A. Chemsak, R.W.T.); 6 ♀, 4 ☿, III-25 to V-7-61 (R.W. Thorp, R.W.T.); 3 ♂, 8 ☿, VI-8 to VIII-18-61 (J. A. Chemsak, J. Powell, R. W. Thorp; C.I.S., R.W.T.).

Discussion.—B. balteatus and *B. sylvicola* have been considered as typically boreal species by most authors and the additional records I have found in California, Nevada and New Mexico also support this idea. However, varieties of both of these species have been described by Frison (1923) from the Patagonia Mountains, Arizona. I have studied the types of *B. sylvicola* var. *lutzi* (Frison), and agree with Frison as to their species assignments. I also concur with his statement that males are needed to decide definitely the taxonomic status of these "varieties." The Patagonia Mountain area contains other apparently incongruous species representa-

tives in other insect groups (Dr. P. D. Hurd, Jr., *in litt.*) and is in need of further investigation.

It has been my experience that *B. sylvicola* and *B. balteatus*, although belonging to different subgenera, have similar distributional patterns and the two have been collected together at many localities, especially in the United States. This is probably due to the similarity in the ecological requirements of the two species. Lutz and Cockerell (1920) have reviewed the North American distributions of these species and additional records may be found in Buckell (1951), Frison (1926, 1929), Henriksen (1937) and Neave (1933). For Palaearctic records see the references to European authors under the species headings.

Frison (1923) advanced the hypothesis that *B. sylvicola* at least "probably occurs in most of the high mountain ranges of the western United States." The new records listed above give support to this hypothesis and show that it also pertains to *B. balteatus*. However, there exist many distributional gaps for these two species in California, Oregon, Nevada and Washington. Doubtless, their rarity at some localities is due to the lack of extensive collecting in the higher elevations of these states. Collections, particularly of males, in these areas and in Arizona will prove very useful in sovling the apparent distributional complexities of these species. There is also a need for a comparative morphological and colorational study of the evident variations throughout the geographic ranges of these species. This should help to determine the correct taxonomic positions of the numerous variations. However, this will not be practical until large series, especially nest samples, from many areas, are available. Also needed is a comparative study of the biologies of widely separated populations (Alaskan vs. Arizonan, Sierran vs. Rocky Mountain, and Nearctic vs. Palaearctic) in order to understand something of the evolution within these species.

Similarly, extensive nest studies are needed on *B. rufocinctus* Cresson throughout its range to determine the basis of the polychromatic variability in this species, which may be due to simple genetic alleles (Stephen, 1957), environmental influences (e. g. temperature and moisture), or a more complex pattern involving both of these possibilities.

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BOOK NOTICES

THE APHIDOIDEA OF THE MIDDLE EAST. By F. S. Bodenheimer and E. Swirski. Jerusalem: The Weizmann Science Press of Israel (available from Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N.Y.). 378 pp., 52 figs. 1957. $12.00.

An erudite treatment of a difficult group, for a region previously without a major work on the subject. There is a list of the aphids of the Middle East, two pages of definitions of the (many specialized) terms in aphid morphology, physiology and ecology, and over 150 pages of detailed ecological treatment. The keys to families, genera and species, with related figures, comprise pp. 179-241, and are followed by a valuable annotated systematic list of the species (245-332) and a list of host plants (335-350).

CHECK-LIST AND BIBLIOGRAPHY ON THE OCCURRENCE OF INSECTS IN BIRDS' NESTS. By E. A. Hicks. Ames: The Iowa State College Press. 681 pp. No date [issued in January, 1959]. $8.50.

A strongly bound and well printed book with over 2,000 entries covering 18 orders of insects and 26 orders of birds, from the literature of the past 150 years. Pages 17-330 cover the entomological check-list, pages 331-594 the ornithological, and there is a 78 page bibliography. Entries are alphabetical in each of the two classes, from ordinal names down. Undetermined insects and nests have separate listings.

WONDER-WORKERS OF THE INSECT WORLD. By H. J. Herbert. Foreword by Lucy W. Clausen. New York: E. P. Dutton & Co., 300 Fourth Ave. 160 pp.. 18 figs. September 17, 1960. $3.00.

A popularized retelling, in dramatic and at times anthropomorphic language, of the activities of some interesting insects and spiders.—HUGH B. LEECH, *California Academy of Sciences, San Francisco.*